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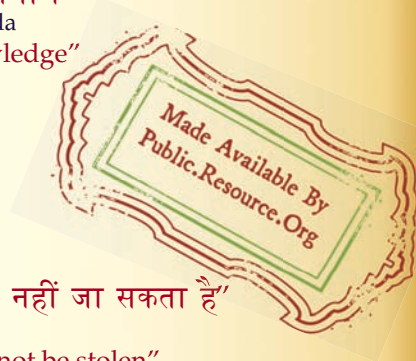
IS 13630-1 (2006): Ceramic Tiles-Methods of Test, Sampling and Basis of Acceptance, Part 1: Determination of Dimensions and Surface Quality [CED 5: Flooring, Wall Finishing and Roofing]



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IS 13630 (Part 1): 2006

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सिरैमिक टाइलें - परीक्षण पद्धतियाँ,
नमूने लेने तथा स्वीकार्यता का आधार
(पहला पुनरीक्षण)

Indian Standard

**CERAMIC TILES — METHODS OF TEST,
SAMPLING AND BASIS FOR ACCEPTANCE**
(First Revision)

ICS 91.100.23

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard (Parts 1 to 15) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Flooring, Wall Finishing and Roofing Sectional Committee had been approved by the Civil Engineering Division Council.

This standard was first published in various parts in 1992-93. This is the first revision; having all parts combined in one publication, of the standard in which the following major changes have been incorporated:

- a) As per the decision taken in the last meeting, the requirements of all the parts have been included in one volume and the revised standard has been brought in line with ISO 10545 (various parts).
- b) The requirements for determination of bulk density have been added in Part 2 and a few changes have been made in the requirements for determination of water absorption.
- c) A few modifications have also been made in Part 3.
- d) Requirements for determination of breaking strength have also been added in Part 6.
- e) Requirements for determination of glazing resistance tests have also been modified in Part 9.
- f) A new test for determination of impact resistance by measurement of co-efficient of restitution has been added as Part 14.
- g) IS 13711 : 1993 'Sampling and basis for acceptance' has been amalgamated with Part 15 of this standard.

In formulation of this standard considerable assistance have been derived from the following standards:

- ISO 10545-1 : 1995 Ceramic tiles — Part 1 : Sampling and basis for acceptance
- ISO 10545-2 : 1995 Ceramic tiles — Part 2 : Determination of dimensions and surface quality
- ISO 10545-3 : 1995 Ceramic tiles — Part 3 : Determination of water absorption, apparent porosity, apparent relative density and bulk density
- ISO 10545-4 : 2004 Ceramic tiles — Part 4 : Determination of modulus of rupture and breaking strength
- ISO 10545-5 : 1996 Ceramic tiles — Part 5 : Determination of impact resistance by measurement of coefficient of restitution
- ISO 10545-6 : 1995 Ceramic tiles — Part 6 : Determination of resistance to deep abrasion for unglazed tiles
- ISO 10545-7 : 1996 Ceramic tiles — Part 7 : Determination of resistance to surface abrasion for glazed tiles
- ISO 10545-8 : 1994 Ceramic tiles — Part 8 : Determination of linear thermal expansion
- ISO 10545-9 : 2004 Ceramic tiles — Part 9 : Determination of resistance to thermal shock
- ISO 10545-10 : 1995 Ceramic tiles — Part 10 : Determination of moisture expansion
- ISO 10545-11 : 1994 Ceramic tiles — Part 11 : Determination of crazing resistance for glazed tiles
- ISO 10545-12 : 1995 Ceramic tiles — Part 12 : Determination of frost resistance
- ISO 10545-13 : 1995 Ceramic tiles — Part 13 : Determination of chemical resistance
- ISO 10545-14 : 1995 Ceramic tiles — Part 14 : Determination of resistance to stains
- ISO 13006 : 1998 Ceramic tiles — Definitions, classification, characteristics and marking

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard***CERAMIC TILES — METHODS OF TEST,
SAMPLING AND BASIS FOR ACCEPTANCE****PART 1 DETERMINATION OF DIMENSIONS AND SURFACE QUALITY***(First Revision)***1 SCOPE**

1.1 This standard (Part 1) covers methods for determining the dimensional characteristics (length, width, thickness, straightness of sides, rectangularity, surface flatness) and the surface quality of all ceramic tiles.

1.2 Tiles with area less than 400 mm² are excluded from measurements of length, width, thickness, straightness of sides, rectangularity, and surface flatness.

1.3 Spacer lugs, glaze bobs and other irregularities of the sides shall be ignored when measuring length, width, and straightness of sides, rectangularity if these are subsequently hidden in the joints after fixing.

2 MEASUREMENTS OF LENGTH AND WIDTH**2.1 Apparatus**

Vernier calipers or other suitable apparatus for linear measurement.

2.2 Test Specimens

Ten whole tiles in each type shall be tested.

2.3 Procedure

Measure each side of the tile under test at positions 5 mm from the corners. Measurements shall be made to the nearest 0.1 mm.

2.4 Expression of Results

The average dimension of square tiles is the average of four measurements. The average dimension of the sample is the average of 40 measurements. For oblong tiles, each similar pair of sides of a tile provides the appropriate average dimension of the tile, an average of two measurements. The average dimensions for length and width are the average of 20 measurements each.

2.5 Test Report

The test report shall contain the following:

- a) Description of the tiles;

- b) All measurements of length and width;
- c) Average size of each test specimen for square tiles; and the average length and width for each oblong tile;
- d) Average size of 10 test specimens for square tiles and the average length and width of oblong tiles;
- e) Deviation in percent of the average size of each tile (2 or 4 sides) from the work size; and
- f) Deviation in percent of the average size of each tile (2 or 4 sides) from the average size of the 10 test specimens (20 or 40 sides).

3 MEASUREMENTS OF THICKNESS**3.1 Apparatus**

Micrometer screw gauge with anvils of 5 mm to 10 mm diameter, or other suitable apparatus.

3.2 Test Specimens

Ten whole tiles in each type shall be tested.

3.3 Procedure

3.3.1 For all tiles except split tiles, draw diagonals between the corners and measure the thickness at the thickest point within each of the four segments. Measure the thickness of each tile under test in four positions to an accuracy of 0.1 mm.

3.3.2 For split tiles, draw four lines at right angles across the extruded projections at distance of 1/8, 3/8, 5/8, 7/8 of the length measured from the end. Measure the thickness at the thickest point on each line.

3.4 Expression of Results

For all tiles the average thickness of each individual tile is the average of four measurements. The average thickness of the sample is the average of 40 measurements.

3.5 Test Report

The test report shall contain the following:

- a) Description of the tiles;

- b) All measurements of thickness;
- c) Average thickness of each test specimen; and
- d) Deviation in percent of the average thickness of each tile (2 or 4 sides) from the work size thickness.

4 MEASUREMENTS OF STRAIGHTNESS OF SIDES

4.1 Terminology

4.1.1 For the purpose of measurement of straightness of ceramic tiles according to this standard, the following definitions shall apply.

4.1.2 *Straightness of Sides* — Defined as the deviation from straightness of the centre of the side in the plane of the tile. The measurement is only relevant to the straight sides of tiles.

4.2 Apparatus

4.2.1 An apparatus as shown in Fig. 1, or other suitable apparatus such as steel square. The dial gauge (A) is used for measuring the straightness of sides.

4.2.2 A calibrating plate made of steel of accurate dimensions and with straight flat sides.

4.3 Test Specimens

Ten whole tiles in each type shall be tested.

4.4 Procedure

4.4.1 Select an apparatus of the appropriate dimensions so that, when a tile is placed in the apparatus, the locating studs are 5 mm from the each corner of the side being measured.

4.4.2 Fit the appropriate calibrating plate exactly into position in the instrument and adjust the dial gauge reading to a suitable known value.

4.4.3 Remove the calibrating plate, place the proper surface of the tile on the locating studs in the apparatus and record the dial gauge reading in the centre of the side. Rotate the tile, if square, to obtain four measurements. Repeat this procedure for each tile. In the case of oblong tiles, use separate instruments of the appropriate dimensions to measure lengths and width. Measure to an accuracy of 0.1 mm.

4.5 Test Report

The test report shall contain the following:

- a) Description of the tiles;
- b) All measurements of straightness of sides; and
- c) Maximum deviation from straightness in percent, related to the corresponding work sizes.

5 MEASUREMENT OF RECTANGULARITY

5.1 Terminology

5.1.1 For the purpose of measurement of rectangularity of ceramic tiles according to this standard, the following definition shall apply.

5.1.2 *Deviation from Rectangularity* — If a corner of the tile is placed against the angle of an accurate calibrating plate, deviation in percent from rectangularity is defined as:

$$\frac{\delta}{L} \times 100$$

where

L = length of the adjacent sides of the tile, and

δ = deviation of the outer corner of the side of the tile (measured 5 mm from the corner) from the inner side of the calibrating plate.

5.2 Apparatus

5.2.1 An apparatus as shown in Fig. 1, or other suitable apparatus such as steel square. The dial gauge (B) is used for measuring the rectangularity of sides.

5.2.2 A calibrating plate, made of steel of accurate dimensions and with straight flat sides.

5.3 Test Specimens

Ten whole tiles in each type shall be tested.

5.4 Procedure

5.4.1 Select an apparatus of the appropriate dimensions so that, when a tile is placed in the apparatus, the locating studs are 5 mm from the each corner of the side being measured. The plunger of the dial gauge (B) shall also be 5 mm from the corner of the tile on the side being measured.

5.4.2 Fit the appropriate calibrating plate exactly into position in the instrument and adjust the dial gauge reading to a suitable known value.

5.4.3 Remove the calibrating plate, place the proper surface of the tile on the locating studs in the apparatus and record the dial gauge reading 5 mm from the corner. Rotate the tile, if square, to obtain four measurements. Repeat this procedure for each tile. In the case of oblong tiles, use separate instruments of the appropriate dimensions to measure lengths and width. Measure to an accuracy of 0.1 mm.

5.5 Expression of Results

Rectangularity shall be expressed as a percentage of the length and width for oblong tiles; and the size for square tiles.

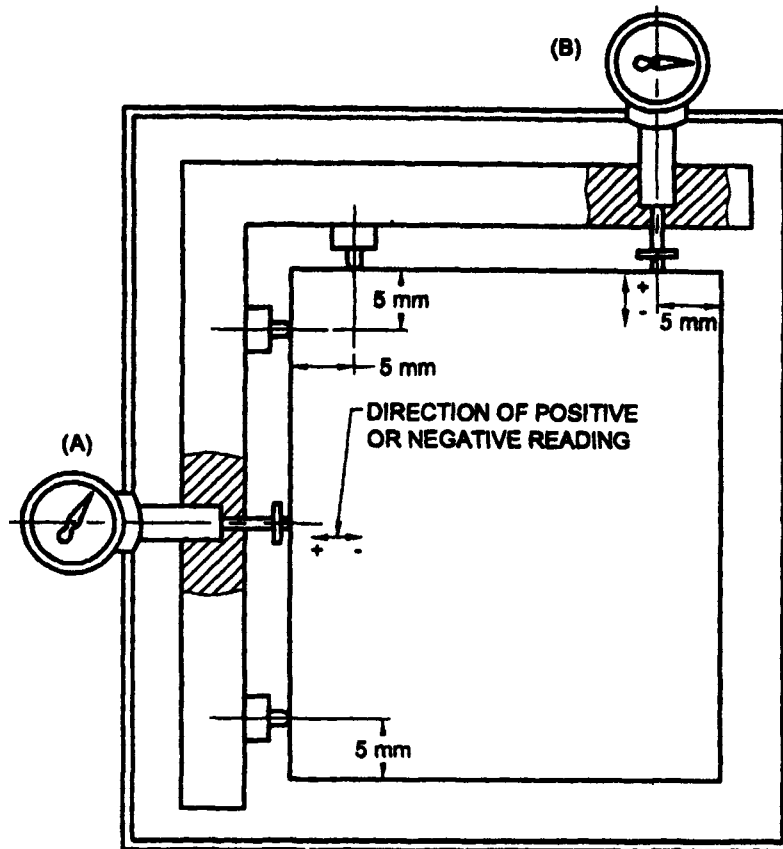


FIG. 1 APPARATUS FOR MEASUREMENT OF STRAIGHTNESS OF SIDES AND RECTANGULARITY

5.6 Test Report

The test report shall contain the following:

- Description of the tiles;
- All measurements of rectangularity; and
- Maximum deviation from rectangularity in percent, related to the corresponding work sizes.

6 MEASUREMENTS OF SURFACE FLATNESS (CURVATURE AND WARPAGE)

6.1 Terminology

6.1.1 For the purpose of measurement of surface flatness (curvature and warpage) of ceramic tiles according to this standard, the following definitions shall apply.

6.1.2 Surface Flatness — Defined by measurements in three positions on the surface of tiles. Tiles that have relief on the proper surface preventing measurements on that surface shall, where possible, be measured on the back.

6.1.3 Centre Curvature — The departure of the centre of a tile from the plane in which three of the four corners lie.

6.1.4 Edge Curvature — The departure of the centre of one edge of a tile from the plane in which three of the four corners lie.

6.1.5 Warpage — The departure of the fourth corner of a tile from the plane in which three of the four corners lie.

6.2 Apparatus

6.2.1 For tiles larger than 40 mm × 40 mm the apparatus given in 6.2.1.1 and 6.2.2.2 shall be used.

6.2.1.1 An apparatus as shown in Fig. 2, or any other suitable instrument. Although only one dial gauge is shown in the figure, there are three on the instrument, located at the centre of one side, at the centre of the tile and at one corner. To measure smooth-surfaced tiles the support studs are 5 mm in diameter. In order to obtain meaningful results for other tile surfaces, suitable support studs shall be used.

6.2.1.2 True flat calibrating plate of metal or glass and at least 10 mm thick for the apparatus described in 6.2.1.1.

6.2.2 For tiles of dimensions 40 mm × 40 mm or less the apparatus given in 6.2.2.1 and 6.2.2.2 shall be used.

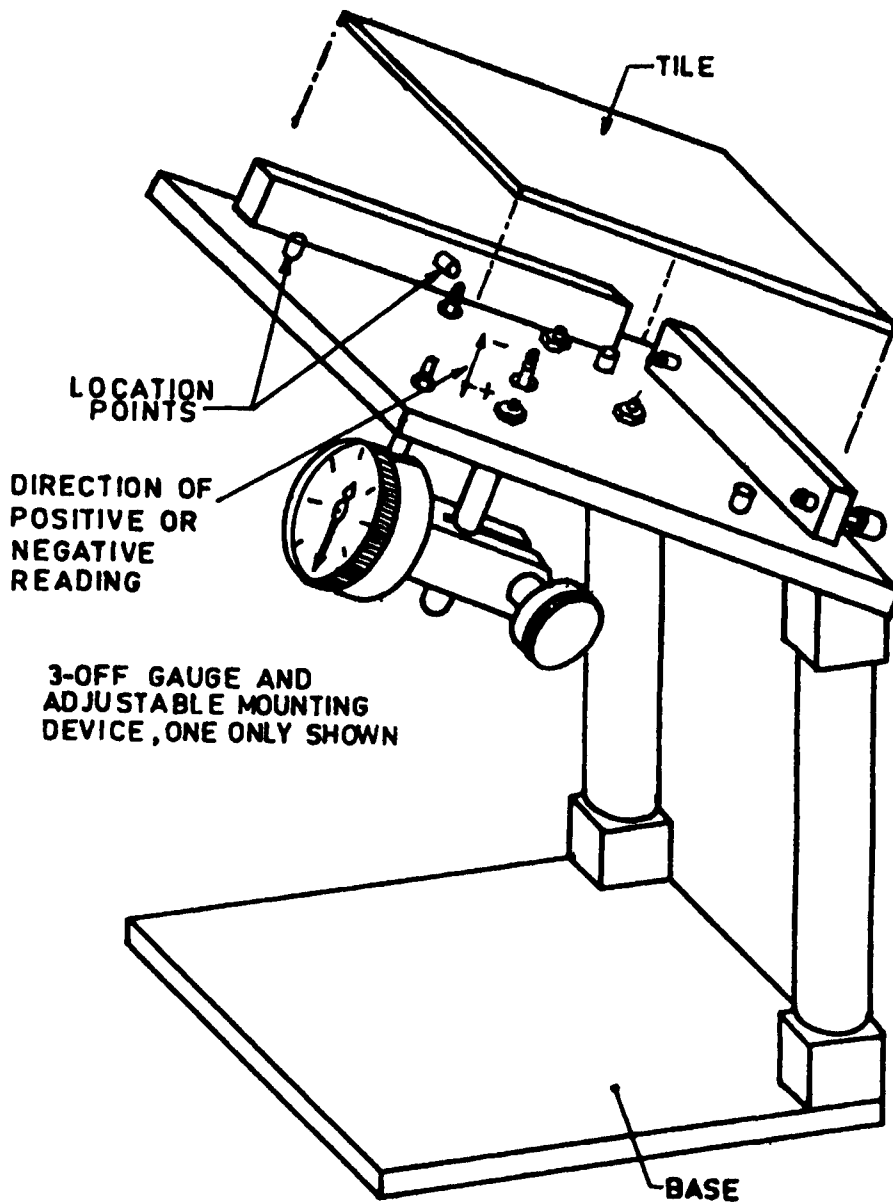


FIG. 2 APPARATUS FOR MEASUREMENT OF SURFACE FLATNESS

6.2.2.1 *Metal straightedge*

6.2.2.2 *Thickness feeler gauges*

6.3 **Test Specimens**

Ten whole tiles in each type shall be tested.

6.4 **Procedure**

6.4.1 *For Tiles Larger Than 40 mm × 40 mm*

6.4.1.1 Select an apparatus of the appropriate size and place the corresponding calibrating plate exactly into positions on top of the three accurately positioned studs.

6.4.1.2 The centre of each stud is 10 mm from the side

of the tile, and the two outer dial gauges are 10 mm from the sides of the tile.

6.4.1.3 Adjust the three dial gauges to a suitable known value.

6.4.1.4 Remove the calibrating plate, place a tile on the apparatus with proper surface of the tile downwards and record the three dial gauge reading in the centre of the side. Rotate the tile, if square, to obtain four measurements of each properties. Repeat this procedure for each tile. In the case of oblong tiles, use separate instruments of the appropriate dimensions. Record the maximum centre curvature, edge curvature and warpage for each tile. Measure to an accuracy of 0.1 mm.

6.4.2 *For Tile Dimension of 40 mm × 40 mm or Less*

6.4.2.1 In order to measure edge curvature, place a straightedge across the edges and measure the gap under the straightedge by means of the feeler gauges. Determine centre curvature in the same manner but along diagonals.

6.4.2.2 There shall be no warpage measurements.

6.5 Expression of Results

6.5.1 Centre curvature is expressed as a percentage of the length of the diagonal.

6.5.2 Edge curvature is expressed as percentage of the length and width, for oblong tiles and percentage of the size for square tiles. Warpage is expressed as a percentage of the length of the diagonal.

6.5.3 Measurements for tiles with spacer lugs shall be expressed in mm.

6.6 Test Report

The test report shall contain the following:

- a) Description of the tiles;
- b) All measurements of centre curvature;
- c) All measurements of edge curvature;
- d) All measurements of warpage;
- e) Maximum centre curvature, in percentage, related to the diagonal calculated from work size;
- f) Maximum edge curvature, in percentage, related to the corresponding work size; and
- g) Maximum warpage, in percentage related to the diagonal calculated from work size.

7 SURFACE QUALITY

7.1 Surface Defects and Intentional Effects

7.1.1 Criteria for assessing the surface quality of glazed, engobed and unglazed tiles are as follows:

- a) Cracks,
- b) Crazing,
- c) Short glazing,
- d) Unevenness,
- e) Depressions,
- f) Holes,
- g) Glaze devitrification,
- h) Specks and spots,
- j) Under glaze faults,
- k) Decorating faults,

- m) Shading,
- n) Nipped edges, and
- p) Nipped corners.

7.1.2 In order to judge whether an intentional decorative effect is acceptable or is a defect; see the relevant clause of the product standard. Cracks, nipped edges and nipped corners cannot be intentional effects.

7.2 Apparatus

7.2.1 *Fluorescent Lighting of Colour Temperature 6 000 K to 6 500 K*

7.2.2 *Meter Rule or Other Suitable Means of Measuring Distance*

7.2.3 *Light Meter*

7.3 Test Specimens

At least 1 m² with a minimum of 30 tiles shall be tested.

7.4 Procedure

7.4.1 Place the tiles with the proper surface under observation so that they can be viewed normally at a distance of 1 m. Illuminate them with an even light intensity of 300 lux at the surface of the tiles and check the light intensity at the centre and each corner of the area of tiles under test.

7.4.2 View the tiles with naked eye (with the aid of a spectacle, if usually worn).

7.4.3 Preparation of the test area and the viewing of the test shall not be performed by the same person.

7.4.4 Intentional effects in the surface shall not be regarded as defects.

7.5 Expression of Results

Surface quality is expressed as the percentage of tiles without defects.

7.6 Test Report

The test report shall contain the following:

- a) Description of the tiles;
- b) Number of tiles tested including the area of tiles tested;
- c) Assessment criteria used; and
- d) Percentage of tiles without defects.

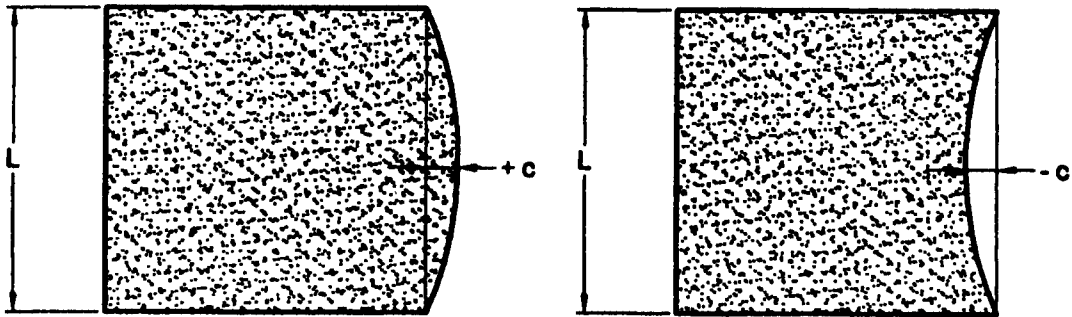


FIG. 3 STRAIGHTNESS OF SIDES; DEVIATION FROM STRAIGHTNESS: c/L

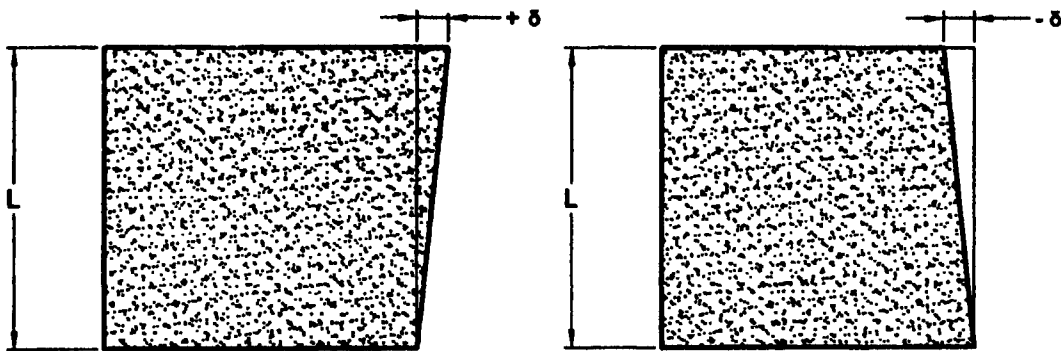


FIG. 4 RECTANGULARITY; DEVIATION FROM RECTANGULARITY δ/L

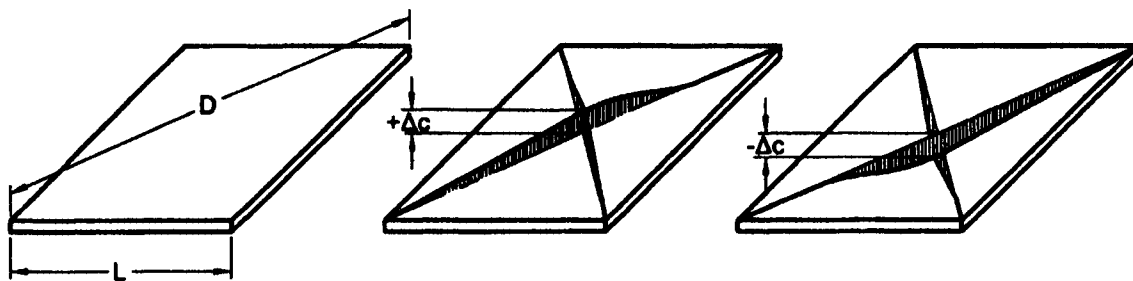


FIG. 5 CENTRE CURVATURE ($\Delta c/D$)

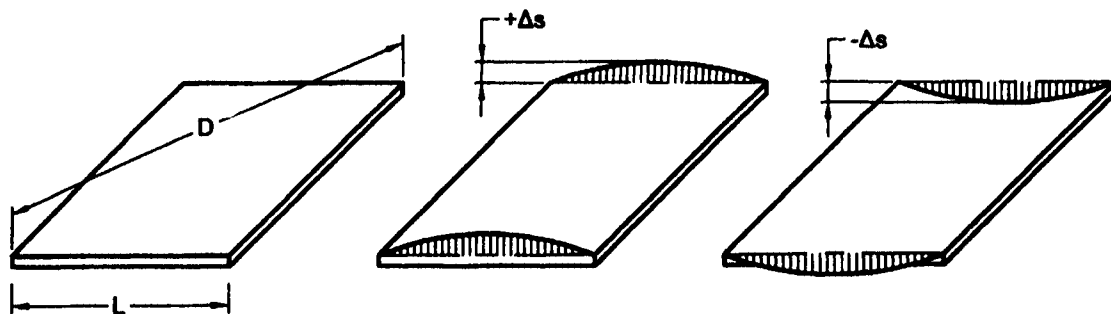


FIG. 6 EDGE CURVATURE ($\Delta s/L$)

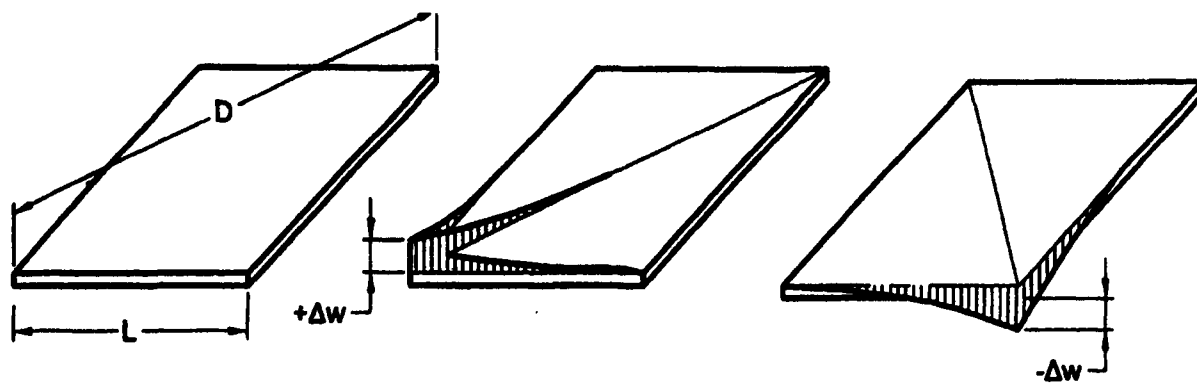


FIG. 7 WARPAGE ($\Delta w/D$)

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

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